

Remarks

We have amended claim 26 to correct a typographical error and to rephrase the element of the claim that requires “direct contact” between a portion of the metal chlorite and at least one acid forming component. “Direct contact” has been rephrased as “having no interposed material,” with support being found in Example 1, page 26, line 23 to page 27, line 2; Example 2, page 27, line 25 to page 28, line 2; Example 3, page 28, lines 19-24; Example 4, page 29, lines 4-9; Example 5, page 29, lines 16-20; Example 6, page 30, lines 5-9; and Example 7, page 30, lines 14-22.

We have added claim 60 specify that the membrane must comprise kraft paper (support on page 22, line 9 of the specification).

We respectfully submit that the amended claim 26, and all claims depending therefrom, define an invention that is novel and non-obvious over the Derwent English abstract No. 1997-311227 of Chinese published patent specification 1104610A, because the reference fails to teach or suggest direct contact between a metal chlorite and acid forming component. The translated Chinese abstract teaches that sodium chlorite reactant must be encapsulated by Chinese wax, stearic acid, bees wax or paraffin wax. The material interposed between the sodium chlorite and the tartaric or oxalic acid creates a barrier that interferes with the sodium chlorite/acid reaction. The production of chlorine dioxide is accordingly hindered, or even prevented in areas where the barrier cannot be breached by the reaction medium, i.e., water. Furthermore, encapsulation is a relatively costly processing step, and encapsulation of a strongly oxidizing material, such as sodium chlorite, with combustible organic materials, like waxes, is dangerous due to the potentially explosive reaction that can occur between the two materials.

In contrast, the present invention requires that at least a portion of the metal chlorite and acid forming component have no interposed material between them, thereby promoting chlorine dioxide production, saving costs, and avoiding hazards relating to the prior art encapsulation.

In addition, the outstanding Office action suggests that when stearic acid is utilized as the encapsulating material in the cited reference, it would constitute an acid forming component in direct contact with the sodium chlorite as required in the claims. However, the acid forming component defined in claim 26 must be selected from one of the following materials: water soluble acids, water soluble acid salts, synthetic molecular sieves, acid ion exchange resins, acid treated clays and acid treated calcined clays. While stearic acid is an acid, it is not water soluble, as evidenced by the attached excerpt from *Handbook of Chemistry and Physics*, CRC Press (1974). Thus, stearic acid is not an "acid forming component" as required in the present claims.

In light of the forgoing, we respectfully submit that the claims, as amended, define a novel and non-obvious invention that fully merits patent protection. We therefore respectfully request that the entire application be allowed at an early date. If there remain any issues that the Examiner believes can be resolved by discussion, the Examiner is cordially invited to contact applicant's undersigned representative at the telephone number provided below.

This amendment is being submitted after three-months, but before four-months, from the December 18, 2002 mailing date of the outstanding Office action. We hereby request a one-month extension for response, and authorization is hereby granted to charge deposit Account No. 05-1070 for the associated fee. If any other fee is required in association with this response, we hereby request and authorize the charging of the fee to deposit Account No. 05-1070.

Respectfully submitted,



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Version with markings to show changes made

Please amend claim 26 as follows:

26. (three-times amended) A device capable of producing an aqueous solution of chlorine dioxide when said device is placed into water, the device comprising a water-permeable membrane defining at least in part an enclosed space containing a mixture of at least one metal chlorite and at least one acid forming component, at least a [of] portion of said at least one metal chlorite and at least one acid forming component having no interposed material [being in direct contact], said acid forming component being selected from the group consisting of water soluble acids, water soluble acid salts, synthetic molecular sieves, acid ion exchange resins, acid treated clays and acid treated calcined clays, and wherein said metal chlorite and said acid forming component are such that they will react with each other in the presence of water but not in the substantial absence of water to produce chlorine dioxide, said membrane comprising a material which permits: (a) controlled passage of liquid water and/or water vapor into the enclosed space to thereby allow the metal chlorite and the acid forming component to react to produce chlorine dioxide and (b) passage of the so produced chlorine dioxide into a body of liquid water to produce the aqueous solution of chlorine dioxide.

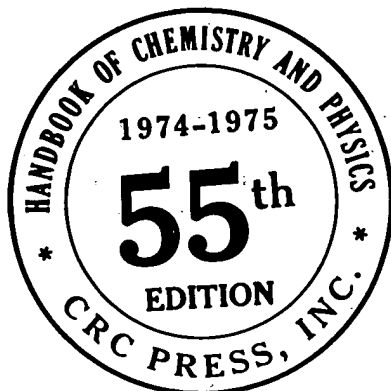
Please add the following new claim 60:

60. (New) The device of claim 26, wherein the membrane comprises kraft paper.



Handbook OF Chemistry and Physics

A Ready-Reference Book of Chemical and Physical Data



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In collaboration with a large number of professional chemists and physicists whose assistance is acknowledged in the list of general collaborators and in connection with the particular tables or sections involved.

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SYMBOLS AND ABBREVIATIONS

[α]	specific rotation
δ	slightly
>	above, more than
<	below, less than
∞	soluble in all proportions
*	name approved by the International Union of Chemists (I.U.C.) ¹
Ω	IR, or UV, or NMR spectra referenced
?	unknown
aa	acetic acid
abs	absolute
ac	acid
Ac	acetyl
ace	acetone
al	alcohol ²
alk	alkali
Am	J. Am. Chem. Soc.
Am	amyl (pentyl)
amor	amorphous
anh	anhydrous
aqu	aqueous
as	asymmetric
atm	atmospheres
b	boiling
B	Beilstein
Ber	Chem. Ber.
bipym	bipyramidal
bk	black ³
bl	blue ³
br	brown ³
bt	bright
Bu	butyl
bz	Benzene
C	Chem. Abs.
c	percentage concentration
ca	about (circa)
chl	chloroform
co	columns
col	colorless
con	concentrated
cor	corrected
cr	crystals
cy	cyclohexane
d	decomposes
D	line in the spectrum of sodium (subscript)
D, d	dextro ⁴
δd	slight decomposition
dil	diluted
diox	dioxane
distb	distillable
dk	dark
DL, dl	racemic ⁴
dlq	deliquescent
DMF	dimethyl formamide
E	Elsevier's
eff	efflorescent
Et	ethyl
eth	ether ⁵
exp	explodes
extrap	extrapolated

fl	flakes
flr	fluorescent
fr	freezes
fr. p.	freezing point
fum	fuming
gel	gelatinous
gl	glacial
gold	golden
gr	green ³
gran	granular
gy	gray ³
h	hot
H	Helv. Chim. Acta
hex	hexagonal
hp	heptane
htng	heating
hx	hexane
hyd	hydrate
hyg	hygroscopic
i	insoluble
i-	iso-
ign	ignites
in	inactive
inflam	inflammable
infus	infusible
irid	iridescent
iso	isooctane
J	J. Chem. Soc.
JOC	J. Org. Chem.
L, l	levo ⁴
la	large
lf	leaf
lig	ligroin
liq	liquid
lo	long
lt	light
m	melting
m-	meta-
M	molar (concentration)
M	Merck Index, 7th Edition
mcl	monoclinic
Me	methyl
met	metallic
micr	microscopic
min	mineral
mod	modification
mut	mutarotatory
n	normal chain, refractive index
N	normal (concentration)
N	nitrogen ⁶
nd	needles
o-	ortho-
oct	octahedral
og	orange ³
oos	ordinary organic solvents
or	or
ord	ordinary
org	organic
orh	orthorhombic
os	organic solvents
p-	para-
pa	pale

par	partial
peth	petroleum ether
pk	pink ³
Ph	phenyl
pl	plates
pr	prisms
Pr	propyl
Prak	J. Prak. Chem.
purp	purple ³
pw	powder
Py	pyrimidine
pym	pyramids
rac	racemic
rect	rectangular
red	red
res	resinous
rh	rhombic
rhd	rhombohedral
s	soluble
s	secondary ⁷
sc	scales
sec	secondary ⁷
sf	softens
sh	shoulder
silv	silvery
sl	slightly (δ)
so	solid
sol	solution
solv	solvent
sph	sphenoidal
st	stable
sub	sublimes
suc	supercooled
sulf	sulfuric acid
sym	symmetrical
syr	syrup
t	tertiary ⁷
ta	tablets
tcl	triclinc
tert	tertiary ⁷
Tet	Tetrahedron
tetr	tetragonal
THF	tetrahydrofuran
to	toluene
tr	transparent
trg	trigonal
undil	undiluted
uns	unsymmetrical
unst	unstable
v	very
vac	vacuum
var	variable
vap	vapor
vic	vicinal
visc	viscous
volat	volatile or volatilises
vt	violet ³
w	water
wh	white ³
wr	warm
wx	waxy
ye	yellow ³
xyl	xylene

1 For I.U.C. rules of nomenclature see General Index.

2 Generally means ethyl alcohol.

3 The abbreviation of a color ending in "sh" is to be read as ending with the suffix "-ish," e.g., grsh means greenish.

4 D, L generally mean configuration and d, l generally mean optical rotation, but there are many examples in the chemical literature for which the meaning of these symbols is ambiguous and/or interchangeable.

5 Generally means diethyl ether.

6 N indicates a position in the molecule.

7 s and sec, or t and tert, are used as convenient.

No.	Name
	Abietic acid
Qa1	Abietic acid . . .
Qa2	—, methyl ester Acacetin
a3	Acenaphth- anthracene
Qa4	Acenaphthene
a5	—, 1-amino-
a6	—, 3-amino-
a7	—, 4-amino-
a8	—, 5-amino-
Qa9	—, 5-bromo-
a10	—, 5-chloro-
a11	—, 5-iodo-
a12	—, 3-nitro-
	—, 1-oxo-
a13	5-Acenaphth carboxylic
Qa14	Acenaphth quinone
a15	3-Acenaph sulfonic a
a16	1-Acenaph
Qa17	Acenaphth
Qa18	Acetaldel
a19	—, bis(2- ethyl) a
a20	—, diace
Qa21	—, dieth
Qa22	—, dimu
Qa23	—, 2,4- pheny (stabl
a24	—, (t form)
Qa25	—, oxii
a26	—, phe zone

For explanati

PHYSICAL CONSTANTS OF ORGANIC COMPOUNDS (Continued)

PHYSICAL CONSTANTS OF ORGANIC COMPOUNDS (CONTINUED)															
No.	Name	Synonyms and Formula	Mol. wt.	Color, crystalline form, specific rotation and λ_{max} (log ϵ)	m.p. °C	b.p. °C	Density	n_D^{20}	Solubility						Ref.
									w	al	eth	ace	bz	other solvents	
o1	Octacosane	$CH_3(CH_2)_{26}CH_3$	394.78	mcl or rh (bz-al)	64.5	431.6 ⁷⁶⁰	0.8067 ²⁰	1.4520 ²⁰	i	...	...	...	...	chl s	B1 ³ , 582
o2	Octacosanoic acid*	$CH_3(CH_2)_{26}CO_2H$	424.76	(ace or aa)	fr 61.4	264 ¹⁰	0.7750 ⁷⁰	1.4330 ⁷⁰	...	...	...	...	...	...	B2 ¹ , 1095
o3	1-Octacosanol*	$CH_3(CH_2)_{27}OH$	410.78	(ace or peth)	90.4	...	0.8191 ¹⁰⁰	1.4313 ¹⁰⁰	...	...	...	...	...	...	B1 ³ , 1849
o4	9,12-Octadecadienoic acid (cis,cis)*	Linoleic acid. $CH_3(CH_2)_4CH=CHCH_2CH=CH(CH_2)_7CO_2H$	280.46	pa ye or col λ^{21} 232 (3.8), 275 (2.9)	83.3	sub	200-50 ¹	0.9022 ²⁰	1.4699 ²⁰	i	...	...	...	chl, CCl ₄ , MeOH	B2 ¹ , 459
o5	—ethyl ester*	Ethyl linoleate. $CH_3(CH_2)_4CH=CHCH_2CH=CH(CH_2)_7CO_2C_2H_5$	308.49	ye or col λ^{21} 198 (4.6), 233 sh (2.1), 270 (1.79)	-5	270-51 ⁸⁰	0.8865 ²⁰	1.4638 ²⁰	i	s	s	...	...	...	B2 ¹ , 461
o6	—methyl ester*	Methyl linoleate. $CH_3(CH_2)_4CH=CHCH_2CH=CH(CH_2)_7CO_2CH_3$	294.48	ye or col λ^{21} 232 (3.78)	-35	215 ²⁰	0.8886 ¹⁸	1.4638 ²⁰	i	s	s	...	...	...	B2 ¹ , 461
o7	10,12-Octadecadienoic acid (trans,trans)*	10,12-Linoleic acid. $CH_3(CH_2)_4CH=CHCH=CH(CH_2)_7CO_2H$	280.45	(bz or al) λ^{21} 233 (3.51)	56-7.5	168-70 ¹	0.8686 ²⁰	1.4689 ²⁰	...	...	...	...	...	...	B2 ¹ , 1476
o8	7,11-Octadecadiyne*	$CH_3(CH_2)_3C\equiv CCH_2CH_2C\equiv C(CH_2)_5CH_3$	246.44	nd (peth)	55 (38-9)	261	...	1.4410 ²⁵	i	...	...	...	...	MeOH v	B2 ¹ , 1068
o9	Octadecanal*	Stearaldehyde. $CH_3(CH_2)_{16}CHO$	268.49	nd (peth)	...	212-3 ¹²	...	1.4410 ²⁵	...	v	v	...	...	lig s	B1 ³ , 772
o10	—dimethyl acetal	1,1-Dimethoxyoctadecane*. $CH_3(CH_2)_{16}CH(OCH_3)_2$	314.56	nd (al or eth-MeOH)	28.18	316.1 ⁷⁶⁰	0.7768 ²⁸	1.4390 ²⁰	i	...	...	...	...	...	Am 80, 6613
o11	Octadecane*	$CH_3(CH_2)_{16}CH_3$	254.51	(w)	fr 52.86	173.5 ¹⁰	0.8618 ²⁰	1.4522 ²⁰	i	s	s	...	...	chl v	B1 ³ , 565
o12	—1-amino*	$CH_3(CH_2)_{17}NH_2$	269.52	nd (al, cr (bz))	fr 84.5	348.8 ⁷⁶⁰	...	...	i	v	...	...	...	...	B4 ¹ , 431
o13	—acetate	$CH_3(CH_2)_{17}NH_2 \cdot CH_3CO_2H$	329.57	nd (al, cr (bz))	fr 84.5	199.5 ¹⁰	...	...	i	v	...	...	...	...	B4 ¹ , 433
o14	—hydrochloride	$CH_3(CH_2)_{17}NH_2 \cdot HCl$	305.98	orh pl (al)	162-3	...	...	...	i	v	...	...	...	peth, AcOEt s	B1 ³ , 567
o15	—1-bromo*	$CH_3(CH_2)_{17}Br$	333.41	cr (al)	28.2	210 ¹⁰	0.9848 ²⁰	1.4631 ²⁰ 1.4594 ³⁰ 1.4531 ²⁰	i	s	s	...	...	...	B1 ³ , 566
o16	—1-chloro*	$CH_3(CH_2)_{17}Cl$	288.95	...	28.6	348 ⁷⁶⁰ 199 ¹⁰	0.8641 ²⁰	1.4531 ²⁰	i	...	...	...	...	chl v	B1 ³ , 139
o17	—1,18-dibromo*	$Br(CH_2)_{18}Br$	412.31	nd or lf (al)	64	205-7 ¹⁵	...	...	i	...	...	...	...	...	B1 ³ , 567
o18	—1-iodo*	$CH_3(CH_2)_{17}I$	380.40	lf (lig), nd (ace or al-ace)	34	383 ⁷⁶⁰ 223 ¹⁰ 240 ¹²	1.0994 ²⁰	1.4810 ²⁰	i	...	...	...	...	...	B2 ¹ , 626
o19	Octadecanedioic acid, diethyl ester*	Diethyl eicosanedioate. $C_2H_5O_2C(CH_2)_{16}CO_2C_2H_5$	370.58	lf (al, AcOEt or bz), nd (bz, diox)	54.5-5.0	210-1 ²	...	...	...	...	...	...	...	...	B1 ³ , 2247
o20	1,18-Octadecanediol*	$HO(CH_2)_{18}OH$	286.50	...	97-9	...	...	...	...	...	...	...	...	...	B1 ³ , 1838
o21	1-Octadecanethiol*	<i>n</i> -Octadecyl mercaptan. $CH_3(CH_2)_{17}SH$	286.57	...	(i) 24-6 (ii) 28 71.5-2.0	188 ¹⁻² 360d 232 ¹⁵ 250-1 ¹²	0.8475 ²⁰ 0.9408 ²⁰	1.4645 ²⁰ 1.4299 ⁸⁰	i	...	...	...	...	chl, CCl ₄ , CS ₂ , to s	B2 ¹ , 346
o22	Octadecanoic acid*	Stearic acid. $CH_3(CH_2)_{16}CO_2H$	284.50	mcl lf (al) λ^{21} 210 (1.69)	109	...	...	...	i	...	...	...	...	chl s	B2, 384
o23	—amide	Stearamide. $CH_3(CH_2)_{16}CONH_2$	283.50	lf (al)	94	153.5 ¹⁰	...	...	i	v	v	s	v	chl s peth δ	B12 ¹ , 148
o24	— <i>N</i> -phenyl-	Stearanilide. $CH_3(CH_2)_{16}CONHC_6H_5$	359.60	nd (al)	72	...	0.8368 ²²	1.4362 ²⁰	i	i	...	...	...	...	B2 ¹ , 360
o24'	—anhydride*	Stearic anhydride. $[CH_3(CH_2)_{16}CO]_2O$	550.96	λ^{21} 243 (4.17)	28 (45-6)	...	0.9075 ³⁰	1.4663 ²⁰	i	...	...	...	...	chl δ	B6 ¹ , 418
o25	—benzyl ester	Benzyl stearate. $CH_3(CH_2)_{16}CO_2CH_2C_6H_5$	374.61	pa ye	27.5	223	0.8552 ²⁰	1.4328 ²⁰	i	s	...	...	...	...	B2 ¹ , 352
o26	—butyl ester*	<i>n</i> -Butyl stearate. $CH_3(CH_2)_{16}CO_2(CH_2)_3CH_3$	340.60	...	23	215 ¹⁵ 202-3 ⁶	...	1.4523 ²⁴	...	...	...	...	...	...	B2, 384
o27	—chloride	Stearyl chloride. $CH_3(CH_2)_{16}COCl$	302.93	...	44 (28-9) (i) 33.4 (ii) 30.9 57	199 ¹⁰	0.8903 ²³	1.0572 ²⁰ (0.8973 ²⁵)	i	i	s	s	v	chl, CS ₂ s aa i	B6 ¹ , 11
o28	—cyclohexyl ester*	...	366.64	...	...	...	...	...	...	...	...	...	...	...	B2 ¹ , 379
o29	—ethyl ester*	Ethyl stearate. $CH_3(CH_2)_{16}CO_2C_2H_5$	312.54	...	...	...	...	...	i	i	s	s	...	...	B2 ¹ , 353
o30	—hexadecyl ester*	Cetyl stearate. $CH_3(CH_2)_{16}CO_2(CH_2)_{15}CH_3$	508.92	lf or pl (eth, aa)	60-1	189-91 ³	0.8780 ²⁰	1.4310 ²⁰	...	...	...	...	...	...	B2 ¹ , 1020
o30'	—2-hydroxyethyl ester*	Glycol monostearate. $CH_3(CH_2)_{16}CO_2CH_2CH_2OH$	328.54	(peth)	...	...	0.8498 ²⁰	...	i	...	...	...	...	...	B2 ¹ , 353
o31	—isobutyl ester	Isobutyl stearate. $CH_3(CH_2)_{16}CO_2CH_2CH(CH_3)_2$	340.60	wax	(i) 22.5 (ii) 28.9	223 ¹⁵ 199 ⁵	...	...	...	...	...	...	...	...	...

For explanations, symbols and abbreviations see beginning of table. For structural formulas see end of table.